Date : avril 29, 2021

Certificate of Analysis – GC Profiling

Sample identification

Internal code : 21D15-ZAA02
Customer identification : Pruche - Canada - EAB878226 - CA55521A
Type : Essential oil
Source : *Tsuga canadensis*
Customer : ZAYAT AROMA

Analysis

Method: PC-MAT-014 ISO - Analysis of the composition of an essential oil or other volatile liquid by FAST GC-FID (in French); identifications validated by GC-MS.
Analyst : Sarah-Eve Tremblay, M. Sc. A., Chimiste
Analysis date : avril 29, 2021

Checked and approved by :

Alexis St-Gelais, M. Sc., chimiste 2013-174

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PHYSICOCHEMICAL DATA

Physical aspect: Clear liquid
Refractive index: 1.4691 ± 0.0003 (20 °C; method PC-MAT-016)

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method.

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Analysis summary – Consolidated contents

New readers of similar reports are encouraged to read table footnotes at least once.

Identification	%	Class
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Toluene	0.03	Simple phenolic
Hexanal	tr	Aliphatic aldehyde
(3*Z*)-Hexenol	0.02	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
Santene	0.40	Normonoterpene
Unknown	tr	Normonoterpene
Bornylene	0.01	Monoterpene
Hashishene	tr	Monoterpene
Tricyclene	6.60	Monoterpene
α-Thujene	0.18	Monoterpene
α-Pinene	22.52	Monoterpene
α-Fenchene	0.05	Monoterpene
Camphene	16.18	Monoterpene
Thuja-2,4(10)-diene	0.06	Monoterpene
Benzaldehyde	tr	Simple phenolic
β-Pinene	2.23	Monoterpene
Sabinene	0.02	Monoterpene
6-Methyl-5-hepten-2-one	tr	Aliphatic ketone
Dehydro-1,8-cineole	0.03	Monoterpenic ether
Myrcene	2.51	Monoterpene
Pseudolimonene	tr	Monoterpene
α-Phellandrene	1.26	Monoterpene
Menthatriene isomer I	0.02	Monoterpene
Δ3-Carene	0.07	Monoterpene
(3*Z*)-Hexenyl acetate	0.01	Aliphatic ester
α-Terpinene	0.36	Monoterpene
1,4-Cineole	0.02	Monoterpenic ether
para-Cymene	0.55	Monoterpene
β-Phellandrene	2.02*	Monoterpene
1,8-Cineole	[2.02]*	Monoterpenic ether
Limonene	3.85	Monoterpene
(*Z*)-β-Ocimene	0.02	Monoterpene
(*E*)-β-Ocimene	tr	Monoterpene
γ-Terpinene	0.43	Monoterpene
Unknown	0.04	Oxygenated monoterpene
Fenchone	0.01	Monoterpenic ketone
γ-Campholenal	0.11	Aliphatic alcohol
para-Cymenene	0.12	Monoterpene
Terpinolene	0.74	Monoterpene
α-Thujone	0.01	Monoterpenic ketone
Linalool	0.06	Monoterpenic alcohol
Nonanal	0.01	Aliphatic aldehyde
endo-Fenchol	0.05	Monoterpenic alcohol

β-Thujone	0.01	Monoterpenic ketone
cis-para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
α-Campholenal	0.04	Monoterpenic aldehyde
Nopinone	tr	Normonoterpenic ketone
trans-Pinocarveol	0.07	Monoterpenic alcohol
Camphor	0.41	Monoterpenic ketone
Camphene hydrate	0.07	Monoterpenic alcohol
Isoborneol	0.04	Monoterpenic alcohol
Pinocamphone	0.01	Monoterpenic ketone
Pinocarvone	0.02	Monoterpenic ketone
Borneol	1.13	Monoterpenic alcohol
α-Phellandren-8-ol	0.05	Monoterpenic alcohol
Isopinocamphone	0.04	Monoterpenic ketone
Terpinen-4-ol	0.47	Monoterpenic alcohol
Cryptone	0.03	Normonoterpenic ketone
para-Cymen-8-ol	0.02	Monoterpenic alcohol
α-Terpineol	0.66	Monoterpenic alcohol
Myrtenal	0.04	Monoterpenic aldehyde
Methyl salicylate	0.01	Phenolic ester
Myrtenol	0.01	Monoterpenic alcohol
Verbenone	0.06	Monoterpenic ketone
Citronellol	0.03	Monoterpenic alcohol
Carvotanacetone	0.01	Monoterpenic ketone
Piperitone	1.52	Monoterpenic ketone
Isobornyl acetate	28.32	Monoterpenic ester
Unknown	0.13	Monoterpenic ester
Unknown	0.11	Unknown
trans-Pinocarvyl acetate	0.08	Monoterpenic ester
Thymol	0.08	Monoterpenic alcohol
Myrtenyl acetate	0.10	Monoterpenic ester
Pin-2-en-8-yl acetate	0.99	Monoterpenic ester
Terpinyl acetate analog	0.03	Monoterpenic ester
Citronellyl acetate	0.01	Monoterpenic ester
Unknown	0.01	Oxygenated monoterpene
α-Ylangene	0.01	Sesquiterpene
α-Copaene	0.04	Sesquiterpene
β-Bourbonene	0.03	Sesquiterpene
trans-Myrtanyl acetate	0.02	Monoterpenic ester
Geranyl acetate	0.04	Monoterpenic ester
β-Elemene	0.02	Sesquiterpene
Longifolene	tr	Sesquiterpene
β-Caryophyllene	1.01	Sesquiterpene
β-Copaene	0.02	Sesquiterpene
trans-α-Bergamotene	0.02	Sesquiterpene
α-Humulene	1.22	Sesquiterpene
trans-Cadina-1(6),4-diene	0.03	Sesquiterpene
γ-Muurolene	0.12	Sesquiterpene
Germacrene D	tr	Sesquiterpene
α-Amorphene	tr	Sesquiterpene
β-Selinene	0.06	Sesquiterpene
α-Selinene	0.08	Sesquiterpene
α-Muurolene	0.06	Sesquiterpene

γ-Cadinene	0.14	Sesquiterpene
(*Z*)-γ-Bisabolene	0.02	Sesquiterpene
δ-Cadinene	0.26	Sesquiterpene
trans-Cadina-1,4-diene	0.02	Sesquiterpene
α-Cadinene	0.01	Sesquiterpene
α-Calacorene	0.01	Sesquiterpene
(*E*)-Nerolidol	0.04	Sesquiterpenic alcohol
Caryophyllene oxide	0.02	Sesquiterpenic ether
Humulene epoxide I	tr	Sesquiterpenic ether
Salvial-4(14)-en-1-one	tr	Aliphatic alcohol
Humulene epoxide II	0.02	Sesquiterpenic ether
10-epi-Cubenol	0.01	Sesquiterpenic alcohol
1-epi-Cubenol	0.01	Sesquiterpenic alcohol
τ-Cadinol	0.01	Sesquiterpenic alcohol
τ-Muurolol	0.01	Sesquiterpenic alcohol
Unknown	0.02	Sesquiterpenic alcohol
Manool	0.05	Diterpenic alcohol
Consolidated total	**98.66%**	

*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total
tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm is set to prioritize data from the most standard DB-5 column, and smallest values so as to avoid overestimating individual content. This process is semi-automatic. Advanced users are invited to consult the "Full analysis data" table after the chromatograms in this report to access the full untreated data and perform their own calculations if needed.

Unknowns: Unknown compounds' mass spectral data is presented in the "Full analysis data" table. The occurrence of unknown compounds is to be expected in many samples, and does not denote particular problems unless noted otherwise in the conclusion.

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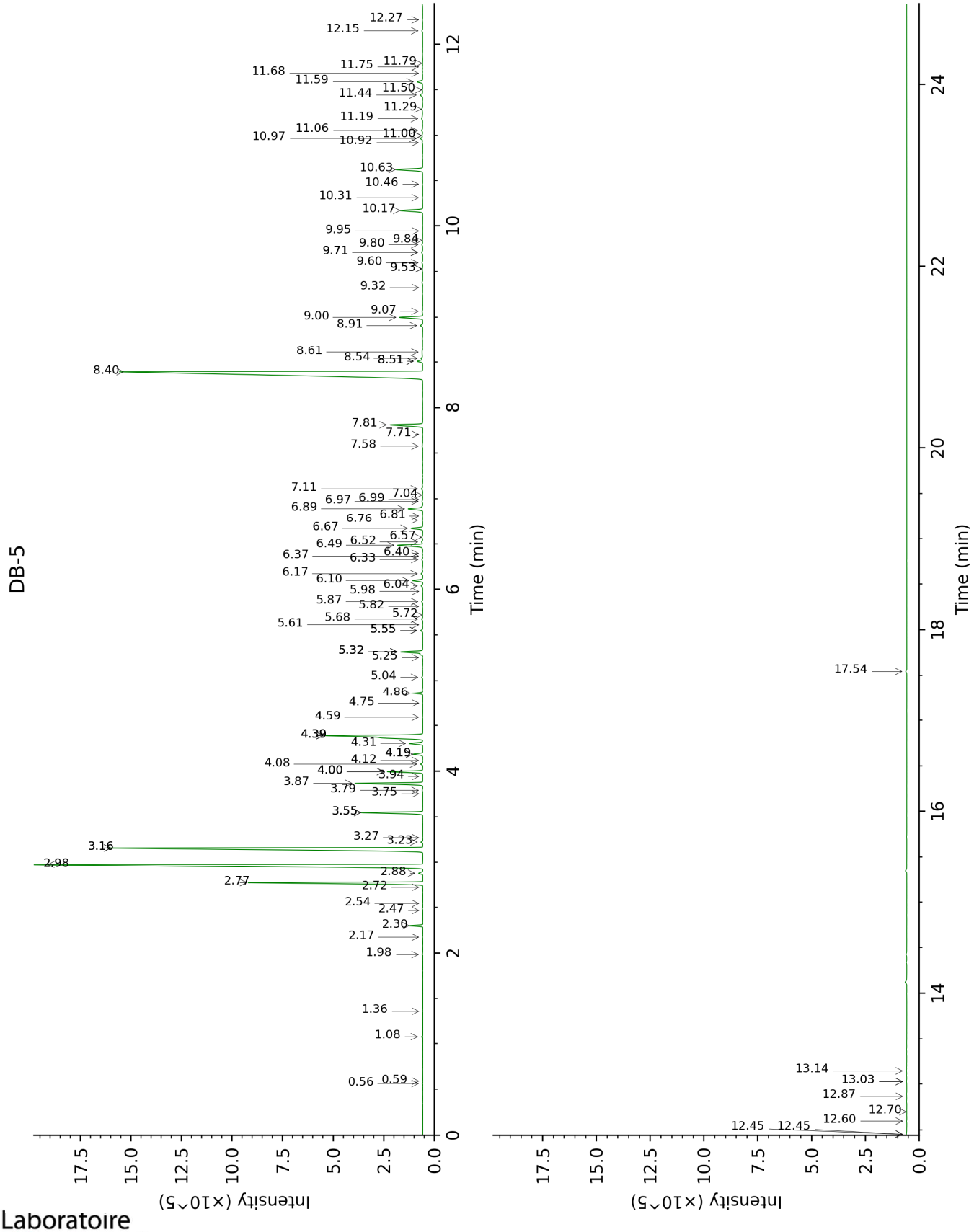

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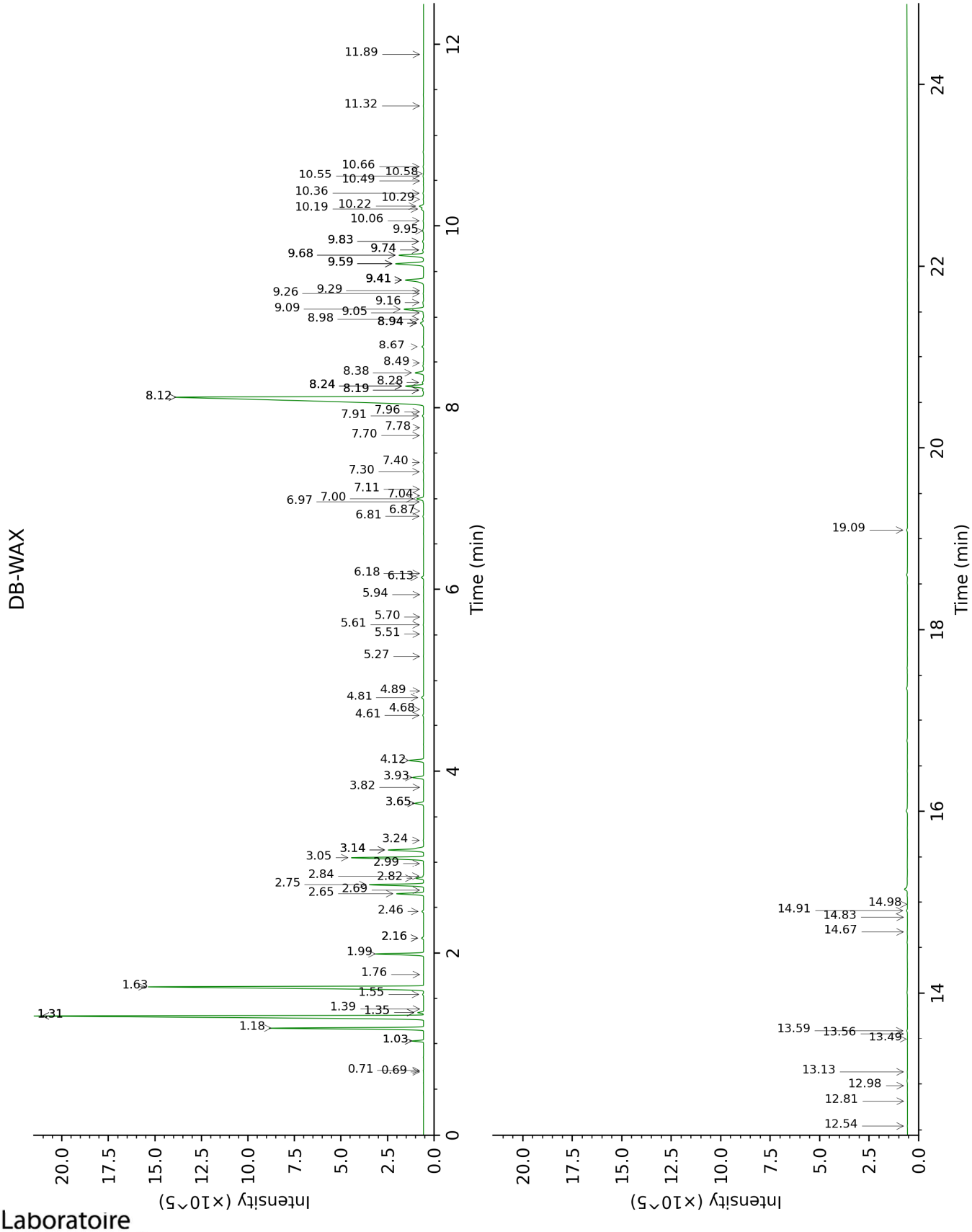
DB-WAX
Time (min)
Intensity (×10^5)
11.89
11.32
10.66
10.55
10.49
10.58
10.36
10.29
10.19
10.22
10.06
9.95
9.83
9.74
9.68
9.59
9.41
9.26
9.29
9.16
9.09
9.05
8.98
8.94
8.67
8.49
8.38
8.24
8.28
8.19
8.12
7.91
7.96
7.78
7.70
7.40
7.30
7.11
7.04
6.97
7.00
6.87
6.81
6.18
6.13
5.94
5.70
5.61
5.51
5.27
4.89
4.81
4.68
4.61
4.12
3.93
3.82
3.65
3.24
3.14
3.05
2.99
2.84
2.82
2.75
2.69
2.65
2.46
2.16
1.99
1.76
1.63
1.55
1.39
1.35
1.31
1.18
1.03
0.71
0.69
19.09
14.98
14.91
14.83
14.67
13.59
13.56
13.49
13.13
12.98
12.81
12.54

FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.56	639	0.01	0.71	887	0.01
2-Methylbutyral	0.59	650	tr	0.69	881	tr
Toluene	1.08	758	0.03	1.35*	1002	0.22
Hexanal	1.36	801	tr	1.76	1044	0.01
(3*Z*)-Hexenol	1.98	856	0.02	5.61	1348	0.02
Hexanol	2.17	873	0.01	5.27	1323	0.01
Santene	2.30	884	0.40	1.03*	949	0.41
Unknown [m/z 79, 93 (66), 94 (52), 91 (39), 77 (37), 122 (31)]	2.47	898	tr	1.39	1006	tr
Bornylene	2.54	905	0.01	1.03*	949	[0.41]
Hashishene	2.72	917	tr	1.31*	997	22.58
Tricyclene	2.77	920	6.60	1.18	974	6.61
α-Thujene	2.88	927	0.18	1.35*	1002	[0.22]
α-Pinene	2.98	934	22.52	1.31*	997	[22.58]
α-Fenchene	3.16*	947	16.23	1.55	1022	0.05
Camphene	3.16*	947	[16.23]	1.63	1030	16.18
Thuja-2,4(10)-diene	3.22	951	0.06	2.16*	1084	0.09
Benzaldehyde	3.27	954	tr	7.11	1458	0.01
β-Pinene	3.55*	973	2.25	1.99	1066	2.23
Sabinene	3.55*	973	[2.25]	2.16*	1084	[0.09]
6-Methyl-5-hepten-2-one	3.75	987	tr	4.89	1298	tr
Dehydro-1,8-cineole	3.79	989	0.03	2.99	1153	0.01
Myrcene	3.87	995	2.51	2.75	1134	2.51
Pseudolimonene	3.94	1000	tr	2.69	1129	0.01
α-Phellandrene	4.00*	1003	1.28	2.65	1126	1.26
Menthatriene isomer I	4.00*	1003	[1.28]	3.24	1174	0.02
Δ3-Carene	4.08	1009	0.07	2.46	1111	0.08
(3*Z*)-Hexenyl acetate	4.12	1011	0.01	4.68	1282	tr
α-Terpinene	4.19*	1016	0.37	2.82	1140	0.36
1,4-Cineole	4.19*	1016	[0.37]	2.84	1142	0.02
para-Cymene	4.31	1023	0.55	3.93	1227	0.55
β-Phellandrene	4.39*	1028	5.86	3.14*	1165	2.02
1,8-Cineole	4.39*	1028	[5.86]	3.14*	1165	[2.02]
Limonene	4.39*	1028	[5.86]	3.05	1158	3.85
(*Z*)-β-Ocimene	4.59	1041	0.02	3.65*	1206	0.44
(*E*)-β-Ocimene	4.75	1051	tr	3.82	1219	0.01
γ-Terpinene	4.86	1058	0.43	3.65*	1206	[0.44]
Unknown [m/z 79, 93 (60), 43 (40), 94 (35), 137	5.04	1069	0.04	4.61	1278	0.05

(33), 77 (26), 91 (20), 152 (18)]						
Fenchone	5.25	1083	0.01	5.51	1340	0.01
γ-Campholenal	5.32*	1087	0.97	4.81	1292	0.11
para-Cymenene	5.32*	1087	[0.97]	6.13	1386	0.12
Terpinolene	5.32*	1087	[0.97]	4.12	1241	0.74
α-Thujone	5.55*	1102	0.08	5.94	1372	0.01
Linalool	5.55*	1102	[0.08]	7.91	1519	0.06
Nonanal	5.61	1106	0.01	5.70	1354	tr
endo-Fenchol	5.68	1110	0.05	8.19*	1541	0.06
β-Thujone	5.72	1113	0.01	6.18	1389	0.01
cis-para-Menth-2-en-1-ol	5.82	1119	0.01	7.96	1522	0.01
α-Campholenal	5.87	1122	0.04	6.81	1436	0.04
Nopinone	5.98	1129	tr	8.12*	1535	28.17
trans-Pinocarveol	6.04	1133	0.07	8.98	1602	0.07
Camphor	6.10	1137	0.41	7.00	1450	0.41
Camphene hydrate	6.17	1142	0.07	8.28	1548	0.07
Isoborneol	6.33	1152	0.04	9.16	1617	0.06
Pinocamphone	6.37	1154	0.01	7.04	1453	0.01
Pinocarvone	6.40	1156	0.02	7.70	1502	0.02
Borneol	6.49	1162	1.13	9.59*	1652	1.75
α-Phellandren-8-ol	6.52	1164	0.05	9.95	1682	0.07
Isopinocamphone	6.57	1168	0.04	7.40	1480	0.03
Terpinen-4-ol	6.67	1174	0.47	8.38	1556	0.49
Cryptone	6.76	1180	0.03	8.94*	1599	0.24
para-Cymen-8-ol	6.81	1183	0.02	11.32	1798	0.02
α-Terpineol	6.89	1188	0.66	9.59*	1652	[1.75]
Myrtenal	6.97	1193	0.04	8.49	1564	0.03
Methyl salicylate	6.99	1194	0.01	10.29	1710	0.03
Myrtenol	7.04	1198	0.01	10.66	1741	0.03
Verbenone	7.11	1202	0.06	9.41*	1637	1.28
Citronellol	7.58	1233	0.03	10.55	1732	0.04
Carvotanacetone	7.71	1242	0.01	9.26	1625	0.03
Piperitone	7.81	1249	1.52	9.68*†	1660	1.62
Isobornyl acetate	8.40	1288	28.32	8.12*	1535	[28.17]
Unknown [m/z 107, 43 (76), 150 (42), 91 (28), 108 (23)]	8.51*	1296	0.24	8.94*	1599	[0.24]
Unknown [m/z 119, 43 (87), 91 (78), 92 (70), 134 (50)...]	8.51*	1296	[0.24]	8.67	1578	0.11
trans-Pinocarvyl acetate	8.54	1298	0.08	8.94*	1599	[0.24]
Thymol	8.61	1303	0.08	14.91	2134	0.05
Myrtenyl acetate	8.91	1324	0.10	9.41*	1637	[1.28]
Pin-2-en-8-yl acetate	9.00	1330	0.99	9.41*	1637	[1.28]

Terpinyl acetate analog	9.07	1335	0.03	9.41*	1637	[1.28]
Citronellyl acetate	9.32	1353	0.01	9.29	1628	0.01
Unknown [m/z 93, 121 (68), 43 (67), 67 (44), 136 (36), 107 (34)... 180 (4)]	9.53*	1368	0.04	9.83*	1672	0.07
α-Ylangene	9.53*	1368	[0.04]	6.87	1440	0.01
α-Copaene	9.60	1372	0.04	6.97	1448	0.01
β-Bourbonene	9.71*	1380	0.06	7.30	1472	0.03
trans-Myrtanyl acetate	9.71*	1380	[0.06]	10.06	1691	0.02
Geranyl acetate	9.80	1386	0.04	10.36	1716	0.04
β-Elemene	9.84	1390	0.02	8.24*	1544	1.02
Longifolene	9.95	1397	tr	7.78	1509	0.01
β-Caryophyllene	10.17	1414	1.01	8.24*	1544	[1.02]
β-Copaene	10.31	1424	0.02	8.19*	1541	[0.06]
trans-α-Bergamotene	10.46	1435	0.02	8.24*	1544	[1.02]
α-Humulene	10.63	1448	1.22	9.09	1611	1.21
trans-Cadina-1(6),4-diene	10.92	1470	0.03	9.05	1608	0.03
γ-Muurolene	10.97	1473	0.12	9.41*	1637	[1.28]
Germacrene D	11.00*	1475	0.04	9.59*	1652	[1.75]
α-Amorphene	11.00*	1475	[0.04]	9.41*	1637	[1.28]
β-Selinene	11.06	1480	0.06	9.68*†	1660	[1.62]
α-Selinene	11.19	1489	0.08	9.74*†	1664	[1.62]
α-Muurolene	11.29	1497	0.06	9.83*	1672	[0.07]
γ-Cadinene	11.44	1509	0.14	10.19	1701	0.13
(*Z*)-γ-Bisabolene	11.50	1513	0.02	9.74*†	1664	[1.62]
δ-Cadinene	11.59	1520	0.26	10.22	1704	0.25
trans-Cadina-1,4-diene	11.68	1528	0.02	10.49	1727	0.01
α-Cadinene	11.75	1533	0.01	10.58	1734	0.01
α-Calacorene	11.79	1536	0.01	11.89	1848	0.01
(*E*)-Nerolidol	12.15	1564	0.04	13.59	2005	0.03
Caryophyllene oxide	12.27	1574	0.02	12.54	1907	0.01
Humulene epoxide I	12.45*	1588	0.06	12.98	1948	tr
Salvial-4(14)-en-1-one	12.45*	1588	[0.06]	12.82	1932	tr
Humulene epoxide II	12.60	1600	0.02	13.13	1962	0.01
10-epi-Cubenol	12.70	1608	0.01	13.50	1996	tr
1-epi-Cubenol	12.87	1622	0.01	13.56	2001	tr
τ-Cadinol	13.03*	1635	0.03	14.67	2110	0.01
τ-Muurolol	13.03*	1635	[0.03]	14.83	2126	0.01
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57),	13.14	1645	0.02	14.98	2140	0.01

79 (43), 161 (43), 109)40)... 204 (35), 222 (2)]						
Manool	17.54	2042	0.05	19.09	2588	0.05
Total identified		**98.74%**			**98.24%**	
Total reported		**98.80%**			**98.41%**	

*: Two or more compounds are coeluting on this column
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total
†: Peaks apexes were resolved, but peaks overlapped and were summed for analysis
tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied
R.T.: Retention time (minutes)
R.I.: Retention index

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